54425

Superfund Proposed Plan

NL Industries, Inc. Operable Unit One

Pedricktown
Salem County, New Jersey

EPA Region 2

July 1993

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes the remedial alternatives and identifies the preferred options for addressing contaminated ground water, surface water, soils and stream sediments at the NL Industries, Inc. (NL) site. In addition, the Proposed Plan includes a discussion of other alternatives evaluated for this Remedial Action, designated as Operable Unit One for the site. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for site activities. EPA will select a remedy for the site only after the public comment period has ended and the information submitted during this time has been reviewed and considered.

THE COMMUNITY'S ROLE IN THE SELECTION PROCESS

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986. This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation and Feasibility Study (RI/FS) Reports and other documents contained in the administrative record file for the NL site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the site and Superfund activities that have been conducted to date. The administrative record file contains the information upon which the selection of the response action will be based. The file is available at the following locations:

Penns Grove Public Library
South Broad Street
Penns Grove, New Jersey 08069
(609) 299-4255

Hours:	M,T,W:	10:00am-1:00pm
	M,T	3:00pm-8:00pm
	W,Th,F:	3:00pm-6:00pm

and

U.S. Environmental Protection Agency
Emergency & Remedial Response Division
Division File Room
26 Federal Plaza, 29th Floor
New York, New York 10278

Hours: M-F: 9:00am-5:00pm

EPA may modify the preferred alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified herein.

DATES TO REMEMBER

Public comment period for Operable Unit One Proposed Plan
July 22, 1993 - August 20, 1993

Public Meeting
August 2, 1993
7:00pm-9:00pm

NLI 002 1975

Oldmans Middle School
Freed Road
Pedricktown, New Jersey 08067

EPA solicits community input on the cleanup methods proposed at each Superfund site. EPA has set a public comment period from July 22, 1993 through August 20, 1993 and encourages public participation in the selection process. The comment period includes a public meeting at which EPA will discuss the Proposed Plan, answer questions and accept oral and written comments.

The public meeting for the site is scheduled from 7:00 pm until 9:00 pm, on August 2, 1993, and will be held at the Oldmans Middle School, which is located on Freed Road in Pedricktown, New Jersey.

Comments on the Proposed Plan will be summarized and responses provided in the Responsiveness Summary section of the Record of Decision. The Record of Decision is the document that presents EPA's final selection for response actions. Written comments on this Proposed Plan should be sent by close of business, August 20, 1993, to:

Michael Gilbert, Project Manager
U.S. Environmental Protection Agency
Emergency & Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278

SITE BACKGROUND

The NL site is an abandoned, secondary lead smelting facility, situated on 44 acres of land on Pennsgrove-Pedricktown Road, in Pedricktown, Oldmans Township, Salem County, New Jersey. The site is bisected by a railroad. Approximately 16 acres are located north of the tracks, including a closed 5.6-acre landfill. The southern 28 acres contain the industrial area and landfill access road (refer to site location map). NL maintains the landfill area and operates the landfill's leachate collection system. The population of Oldmans Township is approximately 1,700.

The West and East Streams, parts of which are intermittent tributaries of the Delaware River, border and receive surface runoff from the site. The nearest home is less than 1,000 feet from the site and B.F. Goodrich and the Tomah Division of Exxon (inactive) are neighboring industrial facilities.

In 1972, the facility began the operation of recycling lead from spent automotive batteries. The batteries we drained of sulfuric acid, crushed and then processed fo lead recovery at the smelting facility. The plastic and rubber waste materials resulting from the battery-crushing operation were buried in the on-site landfill, along with slag from the smelting process.

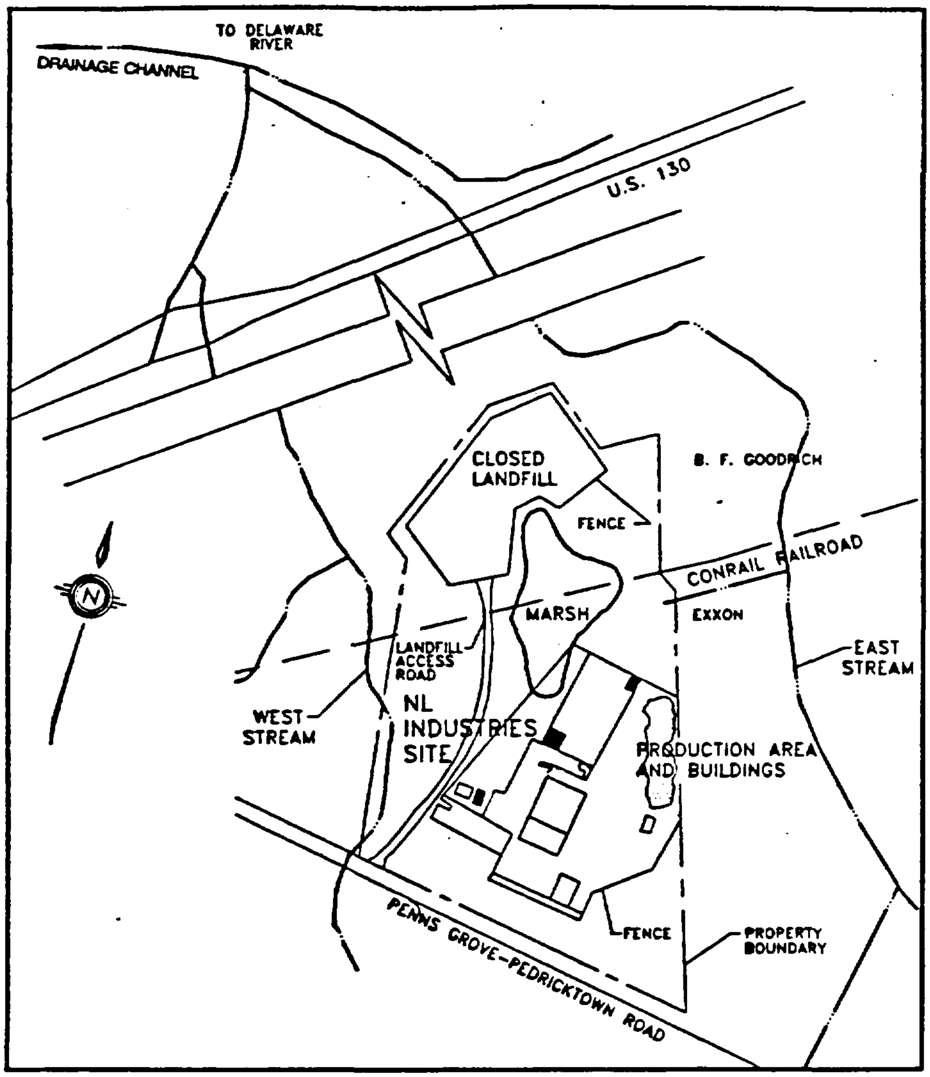
Between 1973 and 1980, the New Jersey Department of Environmental Protection and Energy (NJDEPE) noticed NL with numerous violations of state air and water regulations. Water pollution violations were directed toward the battery storage area and the on-site landfill. NJDEPE conducted an air-monitoring program in 1980 that detected airborne quantities of lead, cadmium, antimony and ferrous sulfate produced by the smelting process, at levels exceeding the facility's operating permits.

NL ceased smelting operations in May 1982. In October 1982, NL entered into an Administrative Consent Order (ACO) with NJDEPE to conduct a remedial program to address contaminated site soils, paved areas, surface water runoff, the on-site landfill and ground water. In December 1982, the site was placed on the National Priorities List (NPL).

In February 1983, the plant was sold to Nation Smelting of New Jersey (NSNJ) and smelting operation recommenced. NSNJ entered into an amended ACO with NJDEPE, National Smelting and Refining Company, Inc., which was NSNJ's parent company, and NL. The amended ACO clarified the environmental responsibilities of NSNJ and NL. NSNJ ceased operation in January 1984, and filed for bankruptcy in March 1984.

In April 1986, NL entered into a consent order with EPA, whereby NL assumed responsibility for conducting a Remedial Investigation and Feasibility Study for the site with EPA oversight. The RI/FS for Operable Unit One was completed in July 1993.

EPA issued a Record of Decision for Operable Unit Two in September 1991. In March 1992, EPA issued a Unilateral Administrative Order to 31 potentially responsible parties (PRPs) ordering them to implement the selected remedy. At the same time, EPA issued an Explanation of Significant Differences to the ROD.



N.L. INDUSTRIES SITE LOCATION
NOT TO SCALE

Removal Action Activities

EPA conducted a multi-phased Removal Action at the site to address several conditions that presented a risk to public health and the environment. EPA conducted Phase One of the Removal Action in March and April 1989 which consisted of construction of a chain-link fence to enclose the former smelting plant and spraying or encapsulation of the on-site slag piles. Encapsulation of the piles provided temporary protection from wind and rain erosion and contaminant migration. In November 1989, EPA began Phase II of the Removal Action. This phase consisted of additional encapsulation of the slag piles, securing the entrances of the contaminated buildings, and removal of over 40,000 pounds of the most toxic and reactive materials.

During March of 1991, EPA performed Phase III of its Removal Action. Damages to the perimeter fence were repaired, a new entrance gate was installed, and all on-site containers stored in open areas were emptied and staged under existing covered areas. Sand/gravel berms were installed around these materials to deter their release. Finally, copper wire and cable were removed from the facility and shipped to EPA's facility in Edison, New Jersey for storage. Theft of this material had been the primary target of trespassers at the site. During July of 1992, Phase IV of the Removal Action reinforced the slag bin retaining walls which were in danger of collapsing.

Phase V of the Removal Action is expected to take place during the summer and fall of 1993. This phase of the Removal Action will involve the removal of the most highly contaminated stream sediments from the West Stream and eliminate them as a source of contamination to the environment. Excavated material will likely be disposed of off site. Upon completion of EPA's action, the Salem County Mosquito Commission (SCMC) may take further action to deepen and widen the stream in order to allow drainage of areas that lie upland of the site.

SCOPE AND ROLE OF THE OPERABLE UNITS

Operable Unit Two

Recognizing the size and complexity of the site, EPA is addressing its remediation in phases, or operable units. Operable Unit Two addressed the slag and lead oxide piles, contaminated surfaces and debris, and contaminated standing water, which were found to be significant and continual sources of contaminant migration from the site. The Operable Unit Two remediation is well underway and is expected to be completed by the fall of 1993.

EPA addressed Operable Unit Two on an expedited basis through a Record of Decision, dated September 1991, and a subsequent Explanation of Significant Differences (ESD) dated March 1992. The ESD provided the option of sending the treated slag off site for disposal. The Early Remedial Action for Operable Unit Two began in November 1992 and was implemented concurrently with the site-wide RI/FS for Operable Unit One.

During the Early Remedial Action, the slag piles, in addition to similar materials, were treated using stabilization technology. After EPA confirmed that the treatment was effective, the treated slag was sent off site for disposal at a Resource Conservation and Recovery Act (RCRA) permitted landfill. The lead oxide piles and other lead-bearing materials were sent to a secondary lead smelter for recycling. Concurrently, buildings, paved surfaces, equipment and debris were decontaminated. At this time, buildings and equipment are being dismantled and recycled as scrap metal or reused as equipment. Hazardous wastes are being shipped to RCRA-regulated facilities.

Once decontamination and dismantling are nearly complete, the remaining contaminated standing water and water used for decontamination will be collected and transported off site for treatment and disposal. Several hundred thousand gallons of water have been shipped off site to prevent flooding during precipitation events. Finally, the entire industrial area of the site will be regraded to prevent further accumulation of water.

Operable Unit One

This Proposed Plan addresses the remediation of the following environmental media which are designated as Operable Unit One: soils; ground water; surface water; and stream sediments. The term "stream sediments," as used throughout this Proposed Plan, refers to contaminated sediments located in the East Stream and the drainage channel north of Route 130.

A site-wide RI/FS has been performed for NL by O'Brien & Gere Engineers, Inc. This RI represents a comprehensive study designed to determine the nature and extent of contamination on the site and areas adjacent to the site. The FS identified and evaluated remedial action alternatives to address contaminant sources and eliminate potential long-term health risks.

EPA also conducted a site-specific ecological assessment to determine the ecological effects of contamination at the site. This study was used to help develop the remedial action objectives for the cleanup of the contaminated media.

REMEDIAL INVESTIGATION SUMMARY

O'Brien and Gere Engineers, Inc. performed the Remedial Investigation for NL Industries. The Remedial Investigation was completed in July 1991 and included a comprehensive study to determine the nature and extent of contamination in site soils, sediments, surface water and ground water. The results of the RI can be summarized as follows:

- The site is underlain by three hydrogeologic units: the unconfined (uppermost and water table) aquifer; the first confined aquifer; and the second confined aquifer.
- Shallow groundwater in the unconfined aquifer generally flows in a northwesterly direction, however, discontinuous layers of sands and clays cause localized variations in flow direction. Groundwater in the first confined aquifer flows in a westerly direction. Groundwater in the second confined aquifer flows in a northeasterly direction, possible influenced by the pumping of industrial supply wells in the area.
- The unconfined aquifer is part of the Cape May Formation and averages approximately 20 feet in thickness. The water level is approximately 5 to

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10 feet below the ground surface. The unconfined and first confined aquifer are separated by a clay layer ranging in thickness from about 5 to 20 feet.

- The first confined aquifer exists approximately 50 to 70 feet below grade and is part of the Raritan Formation. The second confined aquifer is also part of the Raritan Formation. The first and second confined aquifers are separated by a clay layer of approximately 30 feet in thickness.

- A contaminant plume has been detected in the unconfined aquifer below the site. The plume starts at the factory complex and extends in the direction of shallow groundwater flow to the northwest. The plume is comprised primarily of lead and also contains elevated levels of other contaminants. In the shallow zone of the unconfined aquifer, lead concentrations in the vicinity of the factory complex area ranged from 3,130 ppb to 4,400 ppb, and cadmium concentrations ranged from 6 ppb to 173 ppb. In the deep zone of the unconfined aquifer, lead and cadmium concentrations ranged from 9 ppb to 56 ppb and from 3 ppb to 997 ppb, respectively. Arsenic was detected in one well in the unconfined aquifer adjacent to the landfill at concentrations up to 4,200 ppb. Other metals detected on the site at elevated levels include beryllium, chromium, copper, nickel and zinc. A localized area of elevated volatile organic compounds was found in the vicinity of two monitoring wells. These volatile compounds include 1,1,1 trichloroethane, 1,1 dichloroethane, tetrachloroethene and vinyl chloride. Elevated readings of gross alpha and gross beta radiation were detected in one localized area of the site. NL is currently completing an additional study to determine if these levels are naturally occurring.

- The first confined aquifer has not been significantly impacted by contamination in the unconfined aquifer. Lead levels detected in the first confined aquifer ranged from 1 to 3 parts per billion (ppb), except in one well were a level of 12 ppb was detected in 1990. Cadmium was not detected in this aquifer. Only one volatile organic compound, acetone, was detected in one well in the first confined aquifer at a level of 12 ppb.

- The second confined aquifer has not been significantly impacted by site-related contamination. Lead levels detected in this aquifer ranged from 2 to 6 ppb. Arsenic was detected in one well at a level of 2.7 ppb. No cadmium or volatile organic compounds were detected.

- Elevated levels of metals were detected in site soils. Levels of lead were detected in the factory area of the site at levels of up to 12,700 parts per million (ppm), and in areas outside of the factory complex at levels of up to 1,770 ppm. Other metals detected in site soils include: cadmium, arsenic, and zinc.

- Elevated levels of lead, copper and zinc have been detected in the surface water in the West and East Streams as well as the drainage channel north of Route 130. Lead detected in the surface waters of the East and West Streams ranged from 10 ppb to 2,200 ppb in 1989 and 9 ppb to 206 ppb in 1990. The highest levels of lead were detected in the surface waters of the West Stream.

- Elevated levels of lead, copper and zinc have also been detected in the sediments of the West and East Streams as well as the drainage channel located north of Route 130. Lead concentrations in stream sediments ranged from 5 ppm to 26,800 ppm. The highest concentrations were detected in the West Stream adjacent to the factory complex and decreased through the drainage channel toward the Delaware River. Elevated surface water concentrations are believed to be primarily caused by the contaminated soils and sediments, and surface runoff from contaminated sources in the factory complex. Note that West Stream sediments will be addressed through Phase V of EPA's Removal Action in the Fall of 1993. Sediments in the East Stream and drainage channel north of Route 130 are addressed in this Proposed Plan.

In December 1992, EPA performed supplemental soil sampling on site soils to determine what portion of the soils would be classified as RCRA characteristic waste. The results of this analysis, which consisted of Toxicity Characteristic Leaching Procedure testing, revealed that approximately one third of soils contaminated with lead at levels above 500 ppm would be classified as RCRA characteristic waste.

SUMMARY OF SITE RISKS

Human Health Risk Assessment

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future site conditions. The baseline risk assessment estimates the human health risks which could result from the contamination at the site if no remedial action were taken.

A four-step process is utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: *Hazard Identification*--identifies the contaminants of concern at the site based on several factors such as toxicity, frequency of occurrence, and concentration. *Exposure Assessment*--estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water) by which humans are potentially exposed. *Toxicity Assessment*-- determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). *Risk Characterization*-- summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of site-related risks.

The baseline risk assessment began with selecting contaminants of concern which would be representative of site risks. These contaminants included the inorganic compounds (i.e., metals) antimony, arsenic, beryllium, cadmium, chromium, nickel, and zinc, and the organic compounds 1,1-dichloroethane, 1,1-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and vinyl chloride. Several of the contaminants, including arsenic, beryllium, and the five organics above are known to cause cancer in laboratory animals and are suspected to be human carcinogens.

The baseline risk assessment evaluated the health effects which could result from exposure to contamination from soils (ingestion, dermal contact, and inhalation of wind-borne compounds), and ground water (ingestion, inhalation of volatiles while showering, and dermal contact). The risk assessment considered the site's current land use as an abandoned industrial facility, and the future land uses as either an industrial facility o residential area. Current receptors included off-sit residents (child and adult) and off-site workers. Future receptors included on-site residents (child and adult), off-site residents (child and adult), on-site workers, and off-site workers. Ground water use was only considered for future exposure scenarios.

EPA uses reference doses (RfDs) and slope factors to calculate the noncarcinogenic and carcinogenic risk attributable to a particular contaminant. An RfD is an estimate of a daily exposure level that is not likely to result in any appreciable risk of deleterious effects during a person's lifetime. A slope factor establishes the relationship between the dose of a chemical and the response and is commonly expressed as a probability of a response per unit intake of a chemical over a lifetime.

Although EPA has established RfDs and slope factors for chemicals evaluated in the baseline risk assessment, lead currently does not have a RfD, slope factor, or similarly accepted toxicological parameters. Consequently, the risk due to lead cannot be quantified. This is of particular significance at the NL site, since lead is the major contaminant of concern. Therefore lead, which was qualitatively evaluated independent of the other contaminants of concern, will be discussed separatel from the quantitative baseline risk assessment.

The results of the quantitative baseline risk assessment indicate that all exposures to receptors under current land use are acceptable, both in terms of cancer and non-cancer risk. Under potential future land use, all receptors except the on-site worker, have unacceptable risks for both cancer and non-cancer effects due to ground-water ingestion. In addition, all future residents have unacceptable cancer risk via the inhalation of ground water contaminants while showering. The only other unacceptable non-cancer risk under the future land use scenario is that to the on-site child resident, both by ingesting and dermally contacting contaminated soil.

The greatest carcinogenic risk accrues to the (hypothetical) future residents (on-site and off-site) through their ingestion of ground water. The cancer risk is 2×10^{-3}, meaning that 2 excess cancers per 1,000 residents could occur if future residents were to use the contaminated ground water. Current Federal guidelines for acceptable exposures are a maximum excess carcinogenic risk in the range of 10^{-4} to 10^{-6}.

All future residents (children and adults) and the future off-site worker, have unacceptable non-cancer risk. The on-site child resident would have the most significant risk of all of these through ground water ingestion, with a Hazard Index of 17. A Hazard Index greater than 1.0 indicates that the exposure level exceeds the protective level for that particular chemical. Current Federal guidelines for acceptable exposures are a maximum Hazard Index of 1.0. The lowest unacceptable hazard index, which is for the off-site adult resident inhaling volatile ground water contaminants while showering, was 1.0.

As discussed earlier, lead currently does not have a RfD, slope factor, or similarly accepted toxicological parameters and could not be evaluated in the quantitative baseline risk assessment. Therefore, the risks posed by lead have been qualitatively evaluated below for site soils, sediment, and ground water.

Elevated concentrations of lead have been detected on site in the soils, sediments, surface water and ground water. Exposure to lead has been associated with human noncarcinogenic effects. The major adverse effects in humans caused by lead include alterations in red blood cell production and the nervous system. High concentrations in the blood can cause severe irreversible brain damage and possible death. EPA has also classified lead as a "B2" carcinogen, which indicates that it is considered a probable human carcinogen.

With regard to all exposure scenarios considered in the baseline risk assessment, where there was a non-acceptable cancer or non-cancer risk, it is plausible that the cumulative cancer risk and hazard indices would be even higher if the effects of lead be quantitatively included.

<u>Ecological Risk Assessment</u>

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: *Problem Formulation* - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. *Exposure Assessment*--a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. *Ecological Effects Assessment*--literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. *Risk Characterization*--measurement or estimation of both current and future adverse effects.

The ecological risk assessment was conducted during 1992 at the site by EPA's Environmental Response Team. It included a study of contaminant uptake by ecological receptors located at the site, as well as bioaccumulation modelling of contaminant uptake by higher organisms. The results of the ecological study and risk assessment were used in developing the remedial action objective.

Two media potentially posing risks to non-human receptors at the NL site are the stream sediments and wetland soils. These media also contribute to degradation of surface water quality in the East and West Streams and drainage channel. The contaminants of concern are metals, with lead (Pb) being the most widespread, and detected at much higher levels than other metals. For this reason, a site-specific ecological assessment was performed to determine a risk-based clean-up level for lead only, with the assumption that a clean-up commensurate with a safe level of lead would also result in protective levels of the other metals to the ecological receptors. Lead from site soils and sediments enter the food chain via absorption and ingestion. The bioavailability of soil- and sediment-bound lead accumulated by specific components of the food chain, such as small mammals, earthworms and frogs. This data was then utilized in the evaluation of the exposure of lead to organisms which are not directly sampled.

Lead in site soils becomes available to terrestrial fauna (e.g., small mammals) and avian forms when they feed upon earthworms, the latter accumulating body burdens of lead through their deposit-feeding activity. The sediment-borne lead is available for uptake by amphibians (e.g., frogs) that frequent the site's two streams.

Exposures to earthworms were manipulated in the field investigation to be in the range of 120-6,900 ppm dry weight of soil. Although lethality as an endpoint was monitored, the bioaccumulated lead in the worm tissues was recorded for use in a modelling exercise to determine whether this posed a toxicological threat to earthworm predators (i.e., robins, and woodcocks). In a similar fashion, green frogs found on site had their tissues analyzed for lead content. This information was modelled for the potential toxicological threat posed to their natural predators found at the site, the great blue heron, and the mink. Finally, the white-footed mouse was selected as a representative terrestrial species serving as a diet item of the red-tailed hawk, the long-eared owl, the red fox, and the mink.

A hazard quotient approach was utilized to evaluate the likelihood that lead concentrations in site media and animal tissues would produce deleterious effects. In this method, exposure levels are compared to levels which have been shown to cause toxicological effects (i.e., daily lead intake/reference dose = Hazard Quotient). A hazard quotient greater than 1.0 indicates that exposure to contaminants at calculated levels may cause deleterious effects. Results of the risk calculations suggest that significant risk exists at the site at concentrations above 500 ppm of lead for the following species (and with the following associated toxicological endpoint): robin and woodcock nestlings (reduced brain weight and hematocrit), red fox (anorexia and convulsions), and mink (reduced population).

The results of the ecological risk assessment indicate that a clean-up level of 500 ppm for site soils and sediments is appropriate to reduce risks to an acceptable level to ecological receptors.

The human health and ecological risk assessments addressed three exposure media - soils, sediments and ground water. A brief description of each media and remedial action objectives proposed for each media follows. Potentially exposed populations, fate and transport mechanisms and exposure routes were identified for each media.

Contaminated Soils

Elevated concentrations of metals were found in soils, including lead detected up to 12,700 ppm in soils located within NSNJ property and 1,770 ppm in soils located outside of the property. EPA has developed health-based cleanup levels for lead in soil based on a model that predicts blood lead levels in the most sensitive populations (children) from exposure to lead-contaminated air, dust, drinking water, soil, and paint. EPA's "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" recommends using a soil cleanup level within the range of 500-1,000 ppm. As discussed above, EPA's site-specific ecological assessment concluded that 500 ppm of lead is the appropriate remedial action objective for site soils located in wetland areas, as well as stream sediments.

It is estimated that approximately 30,000 cubic yards of soil will be above the remedial action objective of 500 ppm of lead. It is further estimated that about 10,000 cubic yards will fail Toxicity Characteristic Leachability Procedure (TCLP) testing. The 10,000 cubic yard estimate is based on TCLP sampling performed by EPA during the FS which indicated that these soils would be classified as hazardous based on leachability of lead.

If a material fails TCLP testing, then it is characterized as a hazardous waste and is subject to RCRA regulation. RCRA regulation requires treatment before disposal of such wastes. Under RCRA, there is an exemption from treatment for lead-contaminated soils, which may be applicable to portions of the hazardous soils at the NL site. However, EPA will require that for all alternatives which include on-site treatment as an element, *all* site soils which are determined to be hazardous wastes will be treated. This is consistent with CERCLA's statutory preference for treatment, especially since EPA may require treatment for a large portion of the site soils. However, for the soil alternative which calls for the excavation and off-site disposal of all soil above the remedial action objective, EPA will not require treatment of the exempted soil.

Based on the level of contamination detected in the soils, a potential exists for inhalation of contaminated soil by trespassers and nearby receptors. In addition, exposure via accidental ingestion, inhalation or through dermal contact is of potential concern for trespassers, while ingestion and bioaccumulation through the food chain is an environmental concern.

Off-site contaminant migration is an exposure pathway from the NL site. During heavy rainfall, water flowing over contaminated soil flows toward the West Stream. Concentrations of lead in the stream were measured as high as 206 parts per billion (ppb) in surface water samples and 26,800 ppm in stream sediment samples. The lead concentrations in the stream exceed the estimated Ambient Water Quality Criteria of 3.2 ppb for the protection of aquatic life based on chronic toxicity.

Contaminated Ground Water

In the shallow zone of the unconfined aquifer, lead concentrations in the vicinity of the factory complex area ranged from 3,130 ppb to 4,400 ppb, and cadmium concentrations ranged from 6 ppb to 173 ppb. For the deep zone of the unconfined aquifer, lead and cadmium concentrations ranged from 9 ppb to 56 ppb and from 3 ppb to 997 ppb, respectively. The remedial action objective for groundwater remediation is the Practical Quantitation Limit (PQL) of 10 ppb. The PQL is the lowest concentration that can be reliably detected by a laboratory during routine laboratory operating conditions as established by the NJDEPE as part of the New Jersey Groundwater Standards. For lead, the NJ Groundwater Standard is 5 ppb, with a PQL of 10 ppb. The remedial action objective for cadmium is the NJ Groundwater Standard of 4 ppb. Concentrations detected within the groundwater contaminant plume exceed the remedial action objectives for both lead and cadmium.

Arsenic was detected in one well adjacent to the landfill at concentrations up to 4,200 ppb. The remedial action objective for arsenic is the NJ Groundwater Standard PQL of 8 ppb. Other metals detected on the site at elevated levels include beryllium, chromium, copper, nickel and zinc. Volatile organic compounds exceeding the EPA MCLs were found in two wells, and include 1,1,1 trichloroethane, 1,1 dichloroethane, tetrachloroethene and vinyl chloride.

Contaminated Surface Water and Stream Sediments

Elevated levels of lead, copper and zinc have been detected in both the surface water and sediments in the West and East Streams, and the drainage channel north of Route 130. Since lead is the most predominant of the contaminants in sediments, EPA believes that by remediating lead-contaminated sediments, copper and zinc contamination will also be reduced to acceptable levels.

Lead detected in the surface waters of the East and West Streams ranged from 10 ppb to 2,200 ppb in 1989 and 9 ppb to 206 ppb in 1990. These levels exceeded EPA's estimated Ambient Water Quality Criteria of 3.2 ppb. The highest lead concentrations were found in the West Stream adjacent to the factory complex.

Lead concentrations in stream sediments ranged from 5 ppm to 26,800 ppm. The highest concentrations were in the West Stream adjacent to the factory complex and decreased through the drainage channel toward the Delaware River. EPA believes that the elevated surface water concentrations are primarily caused by the contaminated sediments and soil, and surface runoff from contaminated sources in the factory complex. The factory complex sources have been addressed under Operable Unit Two. Therefore, after the contaminated sediments and soils are remediated, it is expected that surface water quality will improve to levels which no longer pose an environmental threat.

As stated above, EPA's ecological risk assessment for the site concluded that the appropriate remedial action objective for lead in stream sediments is 500 ppm. Therefore, the remediation of stream sediments in the East Stream, and drainage channel running to the Delaware River will address all sediments above 500 ppm of lead.

Summary of Risks

In summary, current on- and off-site exposures resulting from contaminated soils, ground water and stream sediments pose an imminent and substantial threat to public health and the environment. EPA believes that by addressing the three contaminated media, surface water quality will also improve to an acceptable level. The proposed remedy will address these media and mitigate their risk to acceptable levels.

SUMMARY OF ALTERNATIVES

The FS presents remedial alternatives to address three areas of hazardous contamination at the site: soils, ground water and stream sediments. A wide range of technologies were considered to address the remedial action objectives for each of these areas. These technologies were screened on the basis of effectiveness, implementability and costs. Those that were not eliminated from consideration during screening were assembled into the remedial alternatives presented below. The term "Months to Achieve Remedial Action Objectives" refers to the amount of time it would take to design, construct and complete the action. "N/A" implies that the "Months to Achieve Remedial Action Objectives" is not applicable for the particular alternative. "O&M Cost" refers to the cost of operation and maintenance during implementation of a particular alternative.

For groundwater alternatives, the term "Months to Construct" refers to the time needed to complete construction of the groundwater treatment system. In general, however, restoring an aquifer to remedial action objectives may require treatment and operation in the order of 30 years.

Although the FS evaluated remedial action objectives for soils of 500 ppm and 1,000 ppm, EPA has chosen 500 ppm as the remedial action objective for soils and stream sediments. All costs presented below are for cleanup of soils and sediments to 500 ppm.

Note that all soil alternatives would disturb approximately nine acres of wetlands which must be remediated to meet remedial action objectives. Additional wetland destruction due to construction of the on-site landfill is up to 0.32 acres, depending upon the necessary capacity of the landfill for each alternative. The maximum capacity of the landfill is approximately 54,000 cubic yards. Any wetlands destroyed or impacted as part of this remediation would require mitigation.

Soils Alternatives

Soil-A: No Action / Institutional Control

Capital Cost:	$149,000
Annual O&M Costs:	$2,000
Total Present Worth Cost:	179,800

Months to Achieve Remedial Action Objective: 3

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for soils not meeting remedial action objectives would include institutional controls and site access restrictions, such as fencing. In addition, assessments would be performed every five years to determine the need for further actions.

Soil-B: Excavate All Soils above the Remedial Action Objective / Treat All Excavated Soils Using Soil Washing / Landfill Non-Hazardous Soils On Site / Backfill Treated Soil Meeting Remedial Action Objectives

Capital Cost:	$22,084,700
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$22,161,700

Months to Achieve Remedial Action Objective: 42

All soils, including soils in wetland areas, not meeting the remedial action objective would be excavated and treated (along with stream sediments) using soil washing. The soil washing technology may utilize both physical size separation and chemical separation to remove contaminants from the soil. Liquid washing fluids would be recycled into the process and later disposed of off site along with extracted contaminants. Washed soil meeting the remedial action objective would be returned into the excavated areas. Washed soil rendered non-hazardous but not meeting the remedial action objective would be placed in a landfill to be constructed on site. Secondary wastes from the soil washing process, including fines, would be treated, and disposed of off-site at an appropriate RCRA-permitted facility. Treatability studies would be required to determine if the remedial action objective could be met, and to the determine the optimum operating parameters for the soil washing system. The treated material would require TCLP testing to confirm that the material is nonhazardous.

Soil-C: Excavate All Soils above the Remedial Action Objective / Treat All Excavated Soils Using Solidification / Stabilization / Landfill Treated Material On Site

Capital Cost:	$13,306,400
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$13,383,400

Months to Achieve Remedial Action Objective: 24

All soils not meeting the remedial action objective would be excavated, treated on site by solidification/stabilization (S/S) (along with stream sediments), and landfilled on site. This technology immobilizes contaminants by binding them into an insoluble matrix. Stabilizing agents such as cement, pozzolan, silicates and/or proprietary polymers would be mixed with the feed material. The equipment is similar to that used for cement mixing and handling. Bench-scale tests would be required to select the proper ratio of stabilizing agents, feed material, and water. Depending on the specific treatment process, the volume of stabilized material may increase up to 50 percent of the original volume. The treated material would require TCLP testing to confirm that the material is nonhazardous. Excess treated material which can not be landfilled on site due to space limitation would be transported and disposed of in a RCRA-permitted facility.

Soil-D: Excavate All Soils above the Remedial Action Objective / Soil Wash Hazardous Soils / Landfill Non-Hazardous Soils On Site / Backfill Treated Soil Meeting Remedial Action Objectives

Capital Cost:	$10,635,500
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$10,712,500
Months to Achieve Remedial Action Objective:	36

All soils not meeting the remedial action objective would be excavated. Excavated soils (along with stream sediments) which are non-hazardous would be landfilled on site. Excavated soils and sediments which are classified as hazardous waste would be treated using soil washing as described under Alternative B, above. Washed soils meeting the remedial action objective would be returned into excavated areas. Washed, non-hazardous soils that do not meet the remedial action objective would be landfilled on site along with the excavated non-hazardous soils. Secondary wastes, such as fines, from the soil washing process would be treated and disposed of off-site at an appropriate RCRA-permitted facility.

The on-site landfill to be constructed to contain non-hazardous soils contaminated above the remedial action objective would include a liner underlying the landfill as well as a geomembrane cap. The base of the landfill would be built up with clean fill to raise the level above the 100-year flood plain. Six inches of gravel would be placed over the geomembrane cover as a drainage layer. Approximately 30 inches of soil would be placed and seeded over the drainage layer.

Soil-E: Excavate All Soils above the Remedial Action Objective / Landfill Non-Hazardous Soils On Site / Solidification/Stabilization of Hazardous Soils / Dispose Treated Soil Off Site

Capital Cost:	$10,344,900
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$10,421,900

Months to Achieve Remedial Action Objective: 24

Under this alternative, soils not meeting the remedial action objective would be excavated. Excavated soils (along with stream sediments) which are non-hazardous would be landfilled on site. Excavated soils (along with stream sediments) which are classified as hazardous would be treated on site using S/S as described in Alternative C. The solidified/stabilized soils would then be disposed of off-site at an appropriate RCRA-permitted facility. The on-site landfill to be constructed for containment of non-hazardous material above the remedial action objectives would be identical to that described in Alternative D.

Soil-F: Excavate All Soils Above the Remedial Action Objective / Solidification / Stabilization Hazardous Soils / Landfill Non-Hazardous Soils On-Site

Capital Cost:	$6,403,350
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$6,480,350

Months to Achieve Remedial Action Objective: 24

Under this alternative, soils not meeting the remedial action objective would be excavated. Excavated soils (along with stream sediments) which are non-hazardous would be landfilled on site. Excavated soils (along with stream sediments) which are classified as hazardous would be treated on site using S/S as described in Alternative C. The solidified/stabilized soils would then be landfilled on site along with the excavated non-hazardous soil. The on-site landfill to be constructed for containment of non-hazardous material above the remedial action objectives would be identical to that described in Alternative D.

Soil-G: Excavate All Soils above the Remedial Action Objective/Dispose Off-Site

Capital Cost:	$15,840,200
Annual O&M Costs:	N/A
Total Present Worth Cost:	$15,840,200

Months to Achieve Remedial Action Objective: 24

All soils not meeting the remedial action objective would be excavated. Based on sampling, hazardous and non-hazardous soils would be segregated. All soil (along with stream sediments) would be transported off site to an appropriate, permitted facility for treatment and disposal based on soil characteristics. It is expected that only some soils classified as RCRA hazardous waste will be treated off site, in compliance with all RCRA requirements, prior to disposal. The most likely treatment for this material is S/S.

__Ground-Water Alternatives__

Below is a description of Ground-Water Alternatives A, B, E, F and G. Alternatives C and D are discussed in the FS Report. They include treatment and reinjection of groundwater through leach fields and infiltration trenches. It is estimated that 30 acres of leach fields and 20 acres of infiltration trenches would be required to implement these alternatives, respectively. These alternatives are not further discussed in the Proposed Plan as they are deemed to be infeasible to construct due the extensive land requirements.

Ground Water-A: No Action

Capital Cost:	$10,000
Annual O&M Costs:	$3,245
Total Present Worth Cost:	$60,000

Months to Construct Remedy:	N/A

The No Action alternative for ground water provides a baseline against which other alternatives may be compared. Institutional controls may be implemented. In addition, assessments would be performed every five years to determine the need for further actions.

Ground Water-B: Pump and Treat with Subsurface Discharge via an Infiltration Pond

Capital Cost:	$3,889,000
Annual O&M Costs:	$523,285
Total Present Worth Cost:	$11,933,000

Months to Construct Remedy:	30-36

This alternative would consist of pumping and treating contaminated ground water on site from the unconfined aquifer. The pumping system may include the existing well point system located on site for the extraction of ground water. This well point system is comprised of 49 well points, or extraction wells. The treatment process may include precipitation, clarification, filtration and, if necessary, ion exchange or ion replacement. In addition, a reverse osmosis unit would be necessary to treat the level of total dissolved solids (TDS) to the NJ Groundwater Standard of 500 ppm. Organic contaminants would be removed by air stripping. Sludges generated during the treatment process would be treated and disposed of off site at a facility capable of accepting these materials. The treatment system would be designed to reduce metal concentrations to meet federal and state discharge standards for ground water. Treatability studies would be required to define the design and operating criteria to meet the required standards for ground-water recharge. Treated water would be discharged to the unconfined aquifer through the construction of a 10 acre infiltration pond.

Ground Water-E: Pump and Treat with Subsurface Discharge via Reinjection Wells to the Unconfined Aquifer

Capital Cost:	$3,731,000
Annual O&M Costs:	$539,055
Total Present Worth Cost:	$12,017,000

Months to Construct Remedy:	30-36

This alternative would consist of pumping and treating contaminated ground water on site from the unconfined aquifer. The ground-water extraction and treatment process would be the same as that described in Alternative B. Treated water would be discharged to the unconfined aquifer through reinjection wells. Problems identified with this alternative include the potential for ground-water mounding which could impact existing structures and lack of required land upgradient of the site. Further hydrogeologic evaluation would be required prior to implementing this alternative.

Ground Water-F: Pump and Treat with Subsurface Discharge via Reinjection Wells to the Confined Aquifer

Capital Cost:	$3,663,000
Annual O&M Costs:	$509,728
Total Present Worth Cost:	$11,498,000

Months to Construct Remedy:	24-36

This alternative would consist of pumping and treating contaminated ground water on site from the unconfined aquifer. The ground water extraction and treatment process would be the same as that described for Alternative B. Treated water would be discharged to the confined aquifer through reinjection wells. Since the unconfined aquifer has not been significantly impacted by site contamination, more stringent requirements than the New Jersey Groundwater Quality Standards must be met to prevent degradation of the aquifer. Discharge criteria would be established under the NJ Anti-Degradation Policy. It is expected that the treatment system described in Alternative B, above, would meet the anti-degradation criteria.

Ground Water-G: Pump and Treat with Direct Discharge to Surface Water

	Stream	Delaware
Capital Cost:	$3,741,000	$3,525,000
Annual O&M Costs:	$510,785	$427,245
Total Present Worth Cost:	$11,592,000	$10,093,000

Months to Construct Remedy: 36-54

Under Alternative G, two sub-alternatives (G-1 and G-2) were developed. Both of these alternatives would consist of pumping and treating contaminated ground water on site from the unconfined aquifer and discharge of the treated ground water to a surface water body. The ground water extraction and treatment process would be similar to that described for Alternative B.

G-1: Surface Water Discharge to the East or West Stream: Lead discharge standards to these surface water bodies are expected to be lower than the remedial action objective for lead of 10 ppb associated with discharge to ground water. The discharge criteria for lead would be the estimated Ambient Water Quality Criteria of 3.2 ppb. For discharge to either the East or West Streams, a discharge standard of 500 ppm for TDS would apply. Treated water would be discharged to the East or West Stream through a discharge pipe.

G-2: Surface Water Discharge to the Delaware River: The Delaware River is located approximately 1.5 miles to the northwest of the site. Since discharge to the Delaware River would constitute an off-site discharge, a New Jersey Pollution Discharge Elimination System (NJPDES) permit would be required. The NJDEPE would develop surface water discharge criteria under its permitting authority. Based on a preliminary analysis, it is not expected that reverse osmosis treatment would be required to meet requirements for TDS under the terms of the NJPDES permit. With the exception of not requiring a reverse osmosis unit, the treatment system described in Alternative B is expected to meet discharge criteria to be established by NJDEPE for discharge to the Delaware River. For this option, treated groundwater would be transported via a pipeline from the treatment plant located on-site to the Delaware River, located approximately 1 1/2 miles north of the site. Appropriate access agreements and permits for the pipeline would be obtained.

Sediments

Sediments-A: No Action

Capital Cost:	N/A
Annual O&M Costs:	$13,580
Total Present Worth Cost:	$209,000

Months to Achieve Remedial Action Objective: 3

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for sediments not meeting the remedial response objective would include institutional controls and access restrictions, along with monitoring of surface water quality in the East Stream and drainage channel north of Route 130. In addition, assessments would be performed every five years to determine the need for further actions.

Sediments-B: Sediment Excavation

Capital Cost:	$2,148,200
Annual O&M Costs:	N/A
Total Present Worth Cost:	$2,148,000

Months to Achieve Remedial Action Objective: 18

Sediments not meeting the remedial action objective in the East Stream and drainage channel north of Route 130 to the Delaware River would be excavated. Sediments would be managed, to the extent practicable, in accordance with the selected soil alternative. Remediation of the stream and drainage channel would be accomplished by excavation and dredging. Most of the dredging could be accomplished from access adjacent to the streams and channel. However, some of the dredging in wide areas of the stream may require a barge-mounted excavation device. Sediments would need to be dewatered prior to handling for treatment and disposal with soils. It is estimated that up to 7,900 cubic yards of sediments would be excavated.

EVALUATION OF ALTERNATIVES

The nine criteria used to evaluate all remedial alternatives fall into four categories: environmental/public health protectiveness, compliance with required cleanup standards, technical performance and cost. In addition, the selected remedy should result in permanent solutions and should use treatment to the maximum extent practicable. This section discusses and compares the performance of the remedial alternatives under consideration for each source against these criteria. The nine criteria are summarized below:

Overall Protection of Human Health and Environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of Federal and State environmental statutes and/or provide grounds for invoking a waiver.

Long-term Effectiveness and Permanence refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once remedial action objectives have been met.

Reduction of Toxicity, Mobility or Volume Through Treatment is the anticipated performance of the disposal or treatment technologies that may be employed in a remedy.

Short-term Effectiveness refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Cost refers to estimates used to compare costs among various alternatives. Costs include both capital and operation and maintenance costs. Cost comparisons are made on the basis of the present worth value, of the entire cost of the alternative, at the beginning of construction.

State Acceptance will be assessed in the Record of Decision following a review of the State's comments received on the FS Report and the Proposed Plan.

Community Acceptance will be assessed in the Record of Decision following a review of the public comment received on the FS Report and the Proposed Plan.

COMPARISON OF ALTERNATIVES

No Action

Soil Alternative-A, No Action, would not provide protection of public health or the environment or any effective remediation in the long or short term. Contaminants would remain in their present state, with little or no reduction in toxicity, mobility or volume. Soil Alternative-A would not achieve the remedial goal of addressing soils which have lead concentrations of greater than 500 ppm. Potential long-term risks due to exposure to and migration of contaminants would remain. Although the No Action alternative is the simplest to implement from a technical standpoint, it would not be effective in achieving protection of human health and the environment.

Ground-Water Alternative-A, the No Action alternative, would not provide protection of public health or the environment or any effective remediation. Contaminated ground water would remain in its present state, with little or no reduction in toxicity, mobility or volume, and may spread over a wider area. This alternative would not meet the remedial action objective for ground water of 10 ppb of lead. In addition, remedial action objectives would not be met for other contaminants which threaten public health and the environment. Potential long-term risks due to exposure to and migration of contaminants would remain. Although the No Action alternative for ground water is the simplest to implement from a technical standpoint, it would not be effective in achieving protection of human health and the environment.

Sediment Alternative-A, No Action for sediments in the East Stream and drainage channel would not provide protection of public health or the environment or any effective remediation in the long or short term. Contaminated sediments would remain in their present state, with little or no reduction in toxicity, mobility or volume, and may spread over a wider area. The No Action alternative would not meet the remedial action objective of 500 ppm of lead for sediments. Further, these sediments would continue to contribute to the degradation of surface water quality. Therefore, surface water would continue to exceed state and federal

Ambient Water Quality Standards. Potential long-term risks due to exposure to and migration of contaminants would remain. Although the No Action Alternative is the simplest to implement from a technical standpoint, it would not be effective in achieving protection of human health and the environment.

Since the No Action alternatives for soil, ground water and sediments would not be protective of human health and the environment, meet remedial action objectives, be effective in the long or short term, or reduce toxicity, mobility or volume of contaminants, they have been eliminated from further consideration.

SOILS

Overall Protection of Human Health and Environment: Soil Alternatives B, C, D, E, F and G would all be protective of human health and the environment. Each of the alternatives would eliminate the exposure pathway of contaminants to human and ecological receptors and the transport mechanisms of contaminants into the environment. Each of the alternatives uses treatment alone, or a combination of both treatment and containment of soils contaminated above the remedial action objective to protect human health and the environment.

Compliance with Applicable or Relevant and Appropriate Requirements: Soil Alternatives B, C, D, E, F and G could all be implemented in compliance with ARARs. The primary ARARs of concern are those which apply to wetland areas (New Jersey Freshwater Wetlands Regulations) and RCRA regulations dealing with the identification, handling, transport, treatment and disposal of hazardous waste. Approximately 1/3 of site soils which exceed the remedial response objective for lead are classified as RCRA characteristic waste. Although a portion of these soils can be land disposed without further treatment, EPA expects to treat all of these soils in Alternatives B, C, D, E and F. Alternatives B and D include soil washing as a principle component. Treated soils would be sampled to determine that the remedial action objective has been met, prior to returning the treated soil to the site. In addition, the leachability of treated soil would be tested to determine if the waste is RCRA characteristic. Any waste that is RCRA characteristic waste would require further treatment (S/S) prior to placement either on or off-site. Alternatives C, E and F include S/S as a primary element. Solidified/stabilized material would be sampled to determine that the material is not RCRA characteristic waste prior to placement of the material either on or off site. Under Alternative G, all soil (along with stream sediments) would be transported off site to an appropriate, RCRA regulated facility for treatment and disposal based on soil characteristics. It is expected that only some soils classified as RCRA hazardous waste will be treated off site, in compliance with all RCRA requirements, prior to disposal. The most likely treatment for this material is S/S.

Since remediation under all of the alternatives, except the No Action alternative, involves excavation and disturbance of wetlands, mitigation of these wetlands will be required under all alternatives. A complete list of ARARs may be found in Section 4 of the FS Report.

Long-term Effectiveness and Permanence: Alternative B has the highest degree of permanence of all the alternatives and includes soil washing as a principle element for all soils above the remedial action objectives. This technology permanently removes contaminants from the soil through treatment. Soil washing employs extraction agents and includes soil excavation, above-ground treatment, isolation and removal or destruction of contaminants and redeposition of cleaned soils. Alternative D employs soil washing as a principle element, but would only treat soils classified as hazardous waste. Other soils above the remedial action objective would be contained on-site without treatment. This alternative also has a high degree of permanence. By comparison, Alternatives C, E and F employ S/S to encapsulate contaminants within the soil matrix, rendering them immobile. Material treated through S/S requires monitoring and maintenance to assure that the contaminants remain immobilized over time. Alternative G includes excavation of contaminated soil from the site and transportation of this material off-site for treatment (as appropriate) and disposal at an appropriate RCRA permitted facility. Alternatives B and D have a higher degree of permanence than Alternatives C, E, F, and G since contaminants are permanently removed from the soil. Alternatives B, C, D, E and F would all result in contaminants remaining on site and would be subject to a five-year review on a permanent basis. However, with all these alternatives, the contaminants remaining on-site will be either be immobilized through S/S treatment (Alternatives C (both hazardous and non-hazardous soils) and F (only hazardous soils)), or contained without treatment in an on-site landfill (non-hazardous soils under Alternatives D, E and F).

Reduction of Toxicity, Mobility, or Volume Through Treatment: Alternatives B and D would reduce the toxicity, mobility and volume of contaminants through soil washing treatment by permanently removing the contaminants from all or some of the contaminated soil. The soil washing process may generate some secondary waste requiring off-site treatment and disposal. Alternatives C, E and F include S/S as a component. S/S involves the mixing of binding agents and/or stabilizers with the contaminated soils to lock the waste within the binder material matrix, or convert it into a more chemically stable form. The long-term stability of the treated waste would need to be evaluated over time to assure the protectiveness of the treatment. Alternatives C, E and F would reduce the mobility of soil contaminants through treatment, but would increase the volume of contaminated material by up to 50 percent. Alternative G includes the excavation and off-site disposal of all soils above the remedial action objective. Under this alternative, soil classified as RCRA hazardous waste would be treated (most likely by S/S) off site prior to disposal. Soil classified as non-hazardous would require no treatment prior to disposal. Therefore, Alternative G would only reduce the toxicity of some of the waste through off-site treatment, and is comparable under this criteria to Alternatives E and F.

Short-term Effectiveness: Alternatives B, C, D, E and F contain on-site treatment elements and could be implemented with minimal disruption to the surrounding community and the environment. Short-term impacts to the community would involve use of local roads for remedial activities, including transporting materials off site for disposal. Only alternative F does not require any off-site transport. Alternative G would involve the most transport of materials off the site. Alternative E provides for the off-site disposal of all hazardous material after treatment by S/S. Alternatives B and D would involve transportation for off-site disposal of secondary process waste. Transport of soil off site would be via truck or rail. Rail transport would require replacing the rail spur which had connected the NL facility to an operating railroad. Rail transport may cause less short-term disruption than transport via truck. All alternatives are expected to take between two and three and one half years to complete.

Implementability: Alternative G is the easiest alternative to implement using standard excavation and transportation techniques. Both rail and truck transportation are available. Soil Alternatives B, C, D, E and F are more complicated since, in addition to the use of standard excavation techniques, on-site treatment would also be implemented. Technology and contractors for the soil washing and S/S treatment systems, included in Alternatives B, C, D, E and F, are available. However, treatability studies would be required for both the soil washing and the S/S technology to determine operating parameters of the systems. For soil washing, a treatability study would need to be performed to determine the efficiency which could be attained as well as the type of washing solution, optimum reaction time, potential methods of regeneration and other wastewater treatment requirements. Soil washing is an innovative technology. Although soil washing has not been fully implemented to treat lead contaminated soils from a battery recycling site such as NL, recent advances show that this technology may be successful at this site. Soil washing has a good probability of successfully treating lead contaminated soils at the NL site, especially if soil washing is combined with an acid extraction (leaching) process for treating the soil fines. Residuals of soil washing would require treatment prior to disposal. Residuals include the wash solution and the soil fines. The treatability study for the S/S technology would determine the appropriate binding agent to be used and the optimal amount of binder. Soil alternatives E and G would utilize more off-site disposal space than the other alternatives and this may make the alternatives less implementable at the time of disposal based on landfill space limitations.

The landfilling and capping component included for non-hazardous soils above the remedial action objectives in alternatives D, E and F could be implemented using standard construction techniques.

Cost: Total present worth value costs range from $6,480,350 for Soil-F to $22,161,700 for Soil-B. Alternative G transports all soil off site for treatment and disposal, thus having higher transportation and disposal costs, compared to higher treatment costs for the other soil alternatives. Alternative B, which would treat all soils above the remedial action objective and use treated soils achieving the remedial action objective as backfill, is desirable because it would minimize that amount of land required for creating a landfill, and minimize the quantity of new soil imported to the site for backfill. However, the cost of this remedy may is significantly higher than other alternatives. Alternative D is less costly than Alternative B while still retaining the benefits

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of soil washing and a reduction in the volume of soil to be landfilled.

GROUND WATER

Overall Protection of Human Health and Environment: Ground-water Alternatives B, E, F, G-1 and G-2 would all be protective of human health by restoring the unconfined aquifer to drinking water standards. However, Alternative B would create an artificial water body containing lead concentrations greater than ambient surface water quality criteria. Therefore, it would not be protective of the environment compared with the other alternatives. Alternatives B, E and F would treat water to drinking water standards and Alternatives G-1 and G-2 would be protective of the environment by treating ground water to the appropriate ambient surface water criteria prior to discharge to the on-site streams or the Delaware River, respectively.

Compliance with Applicable or Relevant and Appropriate Requirements: All alternatives except Alternative A, No-Action, would comply with ARARs. Primary ARARs of concern include the Safe Drinking Water Act, the New Jersey Ground Water Quality Water Standards and the associated Practical Quantitation Limits, New Jersey Surface Water Standards, and Federal Ambient Water Quality Criteria. For Alternative F, the NJ anti-degradation policy applies, and would be complied with. For Alternative G-1, all substantive NJPDES permit requirements would be met. For Alternative G-2, a NJPDES permit for surface water discharge would be obtained.

The treatment system included for all alternatives, except Alterative A, No Action, is conceptually designed to achieve compliance with chemical-specific ARARs for the discharge either to the confined aquifer, the unconfined aquifer, the on-site streams, or the Delaware River at the estimated costs presented in this Proposed Plan. However, if upon operation of the treatment system, it is determined that the selected discharge requirements cannot be achieved, ARARs may be waived pursuant to the statutory waiver provisions of Section 121(d) of CERCLA, based on the technical impracticability of achieving further contaminant reduction.

Long-term Effectiveness and Permanence: All alternatives except for Alternative A would be designed to treat the ground water to meet remedial action objectives and permanently reduce the magnitude of residual risk. Alternatives B and E would have significant, impacts on ground-water flow patterns in the unconfined aquifer which may lead to mounding. Mounding could have a negative impact on existing structures in the vicinity of the site. Alternatives G-1 and G-2 are preferable to Alternatives B and E in that impacts to ground-water hydrology are minimal. Alternatives B, E and F would be designed to treat water to ground-water standards while Alternatives G-1 and G-2 would be designed to treat to surface-water standards.

Reduction of Toxicity, Mobility or Volume Through Treatment: All alternatives except Alternative A would permanently reduce the toxicity, mobility and volume of contamination in the unconfined aquifer through treatment technologies employed in the remedy. The treatment technology for each alternative is described under the Summary of Alternatives section, above.

Short-term Effectiveness: All alternatives, except Alternative A, No Action, would take approximately the same time to complete construction and be implemented. Containment of the contaminant plume may be achieved within approximately 1 to 3 years of operation for Alternatives B, E, F and G. In general, however, restoring an aquifer to remedial action objectives may require treatment and operation in the order of 30 years.

Implementability: Alternative B would be the most difficult to implement because it requires the acquisition of 10 acres of land off site to place the infiltration pond. In addition, Alternatives B and E may be difficult to implement due to potential for mounding in the unconfined aquifer due to the high water table and low transmissivity of the aquifer. Mounding may lead to a negative impact to existing structures in the vicinity of the site, as well as the existing on-site landfill. Alternatives B, E, F, G-1 and G-2 would require similar and available treatment technology and can be constructed on-site. All of these alternatives, except Alternative G-2 would require a reverse osmosis unit to remove TDS in the effluent stream. The reverse osmosis unit requires significant maintenance to ensure efficiency.

The system for surface discharge associated with Alternative G-1 would be easier to construct and maintain than the reinjection components of Alternatives E and F, since reinjection systems are more prone to malfunction due to siltation. For Alternative G-2, a pipeline would be constructed from the site, approximately 1 1/2 miles to the Delaware River to transport and discharge treated ground water. The pipeline could be constructed using standard construction techniques. However, appropriate access agreements must be obtained prior to construction. The discharge pipe would also have to cross underneath the rail road tracks and Route 130, which may require additional access agreements and permits from state and local government, and private parties. Construction of such a pipeline in marshy areas and wetlands may be difficult to implement. Finally, discharge to the Delaware River may require additional sampling in order to determine discharge limits for each contaminant.

Cost: Except for the No Action Alternative, all of the ground-water alternatives would utilize treatment systems that are similar in design, and all alternatives are within 20 percent of each other in costs. The alternatives differ from each other primarily in the method of discharging treated groundwater and the level of treatment needed to meet established discharge standards. All alternatives which include reverse osmosis in the treatment system (Alternatives B, E, F, and G-1) require higher operation and maintenance costs for the same time duration than the alternatives not requiring such a unit (Alternatives A and G-2).

STREAM SEDIMENTS

Overall Protection of Human Health and Environment:

Only Alternative B provides adequate protection of human health and the environment. Human health and environmental risks posed through each pathway are eliminated by removing the contaminated media from the environment.

Compliance with Applicable or Relevant and Appropriate Requirements:

Alternative B could be performed in accordance with ARARs and would meet the remedial action objective. Sediments contribute to the contamination of surface water in the streams and drainage channel. Contamination in surface water is currently above the Federal Ambient Water Quality Criteria and New Jersey Surface Water Standards. Alternative B would address the remediation of surface water to below these standards through removal of the sediments above the remedial action objective, which are a source of surface-water contamination.

Long-term Effectiveness and Permanence

Alternative B would permanently eliminate residual risk posed by contaminated sediments. In conjunction with remediation of surrounding site soils, this alternative would maintain reliable protection of human health and the environment after remedial action objectives have been met.

Reduction of Toxicity, Mobility, or Volume Through Treatment:

For Alternative B, reduction of toxicity, mobility and volume would depend upon the selected soil alternative since sediments would be treated, to the degree possible, in the same manner as the soils.

Short-term Effectiveness:

Alternative B would be effective in the short term and would quickly achieve the remedial action objective. However, normal water flow would be disrupted during remediation. In addition, procedures would need to be implemented to minimize the resuspension and control of contaminated sediment during remediation.

Implementability:

Alternative B is readily implementable using standard construction techniques. However, engineering controls would be required to prevent further contamination while sediments are being excavated.

Cost:

Alternative B is estimated to cost $2,148,200 to remediate the contaminated East Stream and drainage channel to the remedial action objective. Note that the cost of treatment and disposal of excavated sediments are included in the cost of the soil alternatives.

<u>SUMMARY OF THE PREFERRED ALTERNATIVES</u>

The evaluation of the remedial alternatives in the previous section discussed each alternative relative to criteria established under the Superfund law and regulations. The intent of the preferred alternative is to remediate those areas of the site that pose an imminent and substantial threat to human health and the environment.

After careful consideration of all reasonable alternatives, EPA proposes utilizing the following alternatives for the Remedial Action at the NL site:

PREFERRED ALTERNATIVES

Based upon an evaluation of the various alternatives, EPA recommends Soil Alternative D, Ground Water Alternative G-1, and Sediment Alternative B as the preferred alternatives for the site remedy.

Soil

Soil Alternative-D provides for the excavation of all soils above the remedial action objective, soil washing of all hazardous soils, landfilling and capping of non-hazardous soils, and backfilling of soils treated to below the remedial action objective on the site. The preferred alternative satisfies all statutory requirements, including the preference for treatment. Highly contaminated soils, which pose the principal threat at the site will be treated. Lesser contaminated soils will be contained through on-site landfilling and capping. Soil washing permanently removes contamination from the soil and reduces the volume of hazardous waste to be managed.

Soil washing is an innovative treatment technology. A treatability study will be performed to determine the optimum design parameters for a soil washing system. Soil washing is expected to be effective in rendering the soils non-hazardous and is likely to achieve the remedial action objective for significant amounts of the treated soil. Soil washing, combined with on-site landfilling, will minimize the amount of soil necessary to import as backfill for the site and reduce the mobility of all soils above the remedial action objective. It also permanently reduces the toxicity and volume of contaminants in the most highly contaminated portions of the soil. It represents the best balance of evaluation criteria among the soil alternatives. Wetlands impacted by any part of this remediation will be mitigated.

Ground Water

Ground-water Alternative G-1 includes the extraction and treatment of contaminated ground water with direct discharge to one of the on-site streams. This alternative satisfies all of the evaluation criteria, is more implementable than the other ground water alternatives and will comprise the most reliable system for discharging the treated ground water.

Alternative G-1 is the most implementable ground water alternative. It does not require off-site access agreements. The discharge pipe would not have to cross underneath the rail road tracks or Route 130, which may require additional access agreements and permits from state and local authorities, as well as private parties. In addition, the pipe can simply discharge to the adjacent stream, eliminating the necessity of constructing a pipeline to the Delaware River or constructing and maintaining a ground water reinjection system.

Alternative G-1 will meet appropriate surface water discharge criteria developed for the protection of surface water bodies. A NJPDES permit will not be required. However, the substantive requirements of a permit would be met. Alternative G-1 will be protective of human health and the environment. The present worth cost for Alternative G-1 is estimated to be $11,592.

Alternative G-1 will comply with ARARs, is cost effective, implementable and will be effective in the long and short term.

Sediment

Sediment Alternative-B, removal of contaminated stream sediments above 500 ppm of lead, provides for the remediation of contaminated sediments in the East Stream and drainage channel north of Route 130. The results of the ecological risk assessment indicate that a remedial action objective of 500 ppm of lead for site soils and sediment is appropriate to reduce risks to an acceptable level to ecological receptors. Through the remediation of stream sediments, a significant source of surface water contamination will be removed. Surface water will be monitored to determine if Ambient Surface Water Criteria have been met subsequent to completion of the remedy. Sediment Alternative B is implementable, cost effective and reduces the toxicity, mobility and volume of contaminated sediments in the East Stream and drainage channel.

The preferred alternatives provide the best balance among alternatives with respect to the evaluating criteria. EPA believes that the preferred alternatives will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The remedy also will meet the statutory preference for the use of treatment as a principal element.

SUMMARY OF THE PREFERRED ALTERNATIVES

Remedial Alternative	Total Present Worth Cost ($1000)	Months to Achieve Remedial Action Objective
Soil-D: Excavation of All Soils Above Remedial Action Objective / Soil Washing of Hazardous Soils Requiring Treatment / Landfilling of Non-Hazardous Soils On Site / Backfill Treated Soil Meeting Remedial Action Objective	10,712	36
Ground Water-G-1: Pump and Treat with Direct Discharge to the East or West Stream	11,592	36
Stream Sediments B: Sediment Remediation	2,148	24

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